REMARKS

Section 102(b) Rejection:

Applicants have amended claim 1 by incorporating the limitation of claim 4, i.e., by reciting that the metal particles of the bond are welded together. Corcoran does not disclose a bond comprising welded metal particles. Corcoran merely discloses "resin containing metal powder." (See col. 4, lines 26-29.) Thus, claims 1-2 and 4-7 are not anticipated by Corcoran.

In response to the Examiner's objection, Applicants have amended claim 3 by incorporating the contents of original claim 1, thus removing the objection.

Applicants have amended claim 8 by including the limitation that the metal particles in the abrasive tool bond are welded together. Thus, claim 8 is not anticipated by Corcoran.

Section 103 rejection over Corcoran:

The obviousness rejection of claims 9, 11-18, 20-26 and 28-29 directed to a method of cutting and method of making an abrasive tool assumes that Corcoran's teaching of how to dice the integrated circuits that was in use when the Corcoran application was filed (i.e., in 1991) can be automatically transferred to newly developed quad flat, no lead, integrated circuits. In fact, dicing operations in existence ten years ago can not be used for this new generation of integrated circuits. New circuits are made smaller, with different materials and according to higher performance standards. The construction of these newer circuits posed a more difficult cutting environment and product specifications in general have become more demanding as integrated circuit performance has been improved.

1. (currently amended) An abrasive wheel for use in separating one quad flat, no-lead, integrated circuit package from another by cutting through a bridging element which joins them, each package comprising a printed circuit board in a protective body therefor, the abrasive wheel comprising a disc formed of abrasive material comprising abrasive particles bonded in a matrix comprising cured polyimide resin, and metal particles, <u>wherein the metal particles have been welded together,</u> the disc forming a cutting edge having a maximum thickness of the order of 350 micron, whereby the cut is substantially straight and is substantially free of smears and burrs.

2. (original) An abrasive wheel according to Claim 1, wherein the disc has a thickness of 300 microns ± 12.7 microns.

3. (currently amended) <u>An abrasive wheel for use in separating one quad flat, no-lead, integrated circuit package from another by cutting through a bridging element which joins them, each package comprising a printed circuit board in a protective body therefor, the abrasive wheel comprising a disc formed of abrasive material comprising abrasive particles bonded in a matrix comprising cured polyimide resin,</u> [An abrasive wheel according to claim 2,] wherein the resin is formed by the reaction of 4,4'-oxydianiline and 3,3',4,4'-benzophenonetetracarboxylic dianhydride, <u>and metal particles, the disc forming a cutting edge having a maximum thickness of the order of 350 micron, whereby the cut is substantially straight and is substantially free of smears and burrs</u>.

4. (cancelled)

5. (currently amended) An abrasive wheel according to Claim [4] <u>1</u>, wherein the metal particles are selected from one or more of copper, tin, nickel, cobalt, iron, zinc, indium, antimony and chromium.

6. (original) An abrasive wheel according to Claim 1, wherein the abrasive particles are natural or synthetic diamond or CBN.

7. (original) An abrasive wheel according to Claim 1, wherein the wheel comprises a disc having a central hole for mounting on a rotary shaft.

8. (currently amended) Cutting apparatus for use in separating one quad flat, no-lead, integrated circuit package from another by cutting through a bridging element which joins them, the apparatus comprising a plurality of abrasive wheels, each wheel comprising a disc formed of abrasive material comprising abrasive particles bonded in a matrix comprising cured polyimide resin and metal particles, <u>wherein the metal particles have been welded together,</u> the disc forming a cutting edge having a maximum thickness of the order of 350 micron, the wheels being mounted in parallel on a common shaft, whereby cuts in parallel bridging elements may be made when the shaft is rotated, and whereby the cut is substantially straight and is substantially free of smears and burrs.

9. (original) A method of separating one quad flat, no-lead, integrated circuit package from another by cutting through a metal bridge elements joining adjacent packages, each package comprising a printed circuit board in a protective body therefor, the method comprising rotating an abrasive wheel to cut through a bridge element, the wheel having a cutting edge having a maximum thickness of the order of 350 micron and formed of bonded abrasive particles in a matrix comprising cured polyimide resin and metal particles, whereby the cut is substantially straight and little or no smears or burrs are formed on the cut surface.

10. (original) A method according to Claim 9, wherein the resin is formed by the reaction of 4,4'–oxydianiline and 3,3',4,4'–benzophenone tetracarboxylic dianhydride.

11. (original) A method according to Claim 9, wherein the metal particles are welded together in the matrix.

12. (original) A method according to Claim 11, wherein the metal particles are selected from the group of copper, tin, nickel, cobalt, iron, zinc, chromium, antimony, indium, aluminum and titanium.

13. (original) A method according to Claim 9, wherein the wheel is rotated at about 11,000 to about 17,300 rpm surface feet/minute.

14. (original) A method according to Claim 13, wherein the wheel is rotated at 15,708 rpm surface feet/minute.

15. (original) A method according to Claim 9, wherein the bridging element is a 200 to 400 micron thick layer of copper.

16. (original) A method according to Claim 9, wherein the distance between the adjacent packages is 350 micron.

17. (original) A method of separating one quad flat, no lead, integrated circuit package from another by cutting through a metal bridge element by which one package is joined to the other, each package comprising a printed circuit body in a protective body, the method comprising rotating an abrasive wheel having a cutting edge to cut through the bridging element, the edge having a maximum thickness of the order of 350 micron and being formed of abrasive particles held in a matrix comprising cured polyimide resin and metal particles, whereby the cut is substantially straight and the cut surface is substantially free of smears and burrs.

18. (original) A method according to Claim 17, wherein the cutting edge has a thickness of 300 microns ±12.7 microns.

19. (original) A method according to Claim 17, wherein the resin is formed by the reaction of 4,4'–oxydianiline and 3,3',4,4'–benzophenone tetracarboxylic dianhydride.

20. (original) A method according to Claim 17, wherein the metal particles are selected from the group of copper, tin, nickel, cobalt, iron, zinc, chromium, indium and antimony.

21. (original) A method according to Claim 17, wherein the wheel is rotated at about 14,137 surface feet/minute and a feed rate of from about 18 to about 30 mm/s.

22. (original) A method according to Claim 21, wherein the wheel is rotated at 15,708 surface feet/min.

23. (original) A method according to Claim 17, wherein the metal bridging element is formed of copper.

24. (original) A method according to Claim 23, wherein the bridging element has a thickness of from 200 to 400 micron.

25. (original) A method according to Claim 17, wherein the distance between the adjacent packages is 350 micron.

26. (original) A method of making an abrasive wheel having a cutting edge adapted to cut through a bridging element joining two integrated circuit packages and to leave a substantially straight cut substantially free of smears and burrs, the method comprising subjecting to temperature and pressure a composition comprising abrasive particles, metal particles and of a polyimide resin to cause the formation of a matrix having a high glass transition temperature containing the abrasive particles and the metal particles to weld together within the matrix, in a mould shaped to form an annulus defining a cutting edge having a maximum thickness of the order of 350 micron.

27. (original) A method according to Claim 26, wherein the resin is formed by the reaction of 4,4'-oxydianiline and 3,3', 4,4'-benzophenone tetracarboxylic dianhydride.

28. (original) A method according to Claim 26, wherein the metal particles are selected from the group of copper, tin, nickel, cobalt, iron, zinc, chromium, antimony, indium, aluminum and titanium.

29. (original) A method according to Claim 26, wherein the abrasive particles are natural or synthetic diamond or CBN.